

Advancing Methane Recovery and Use in the Oil and Gas Industry: Domestic and International Partnership Opportunities



Methane to Markets



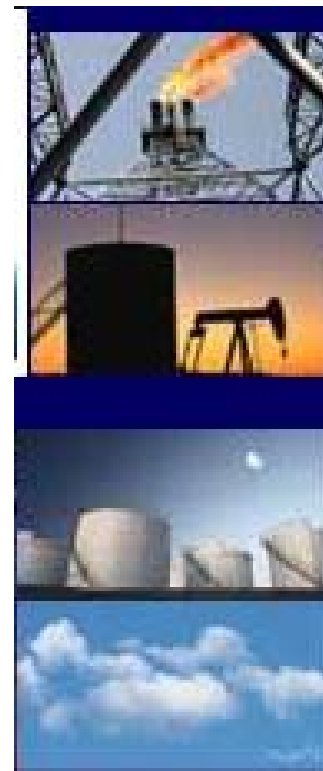
Dina Kruger
Director, Climate Change Division
U.S. Environmental Protection Agency



September 26, 2006

Overview

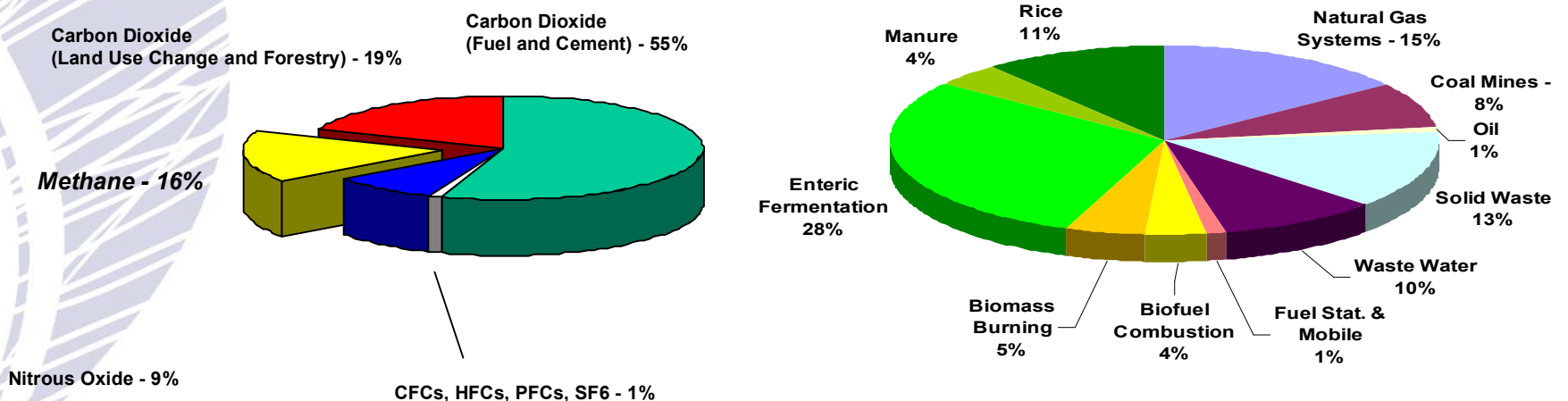
- 💧 The Importance of Methane
- 💧 Natural Gas STAR
- 💧 Methane to Markets and International Gas STAR
- 💧 Asia/Pacific Partnership



Why focus on Methane?

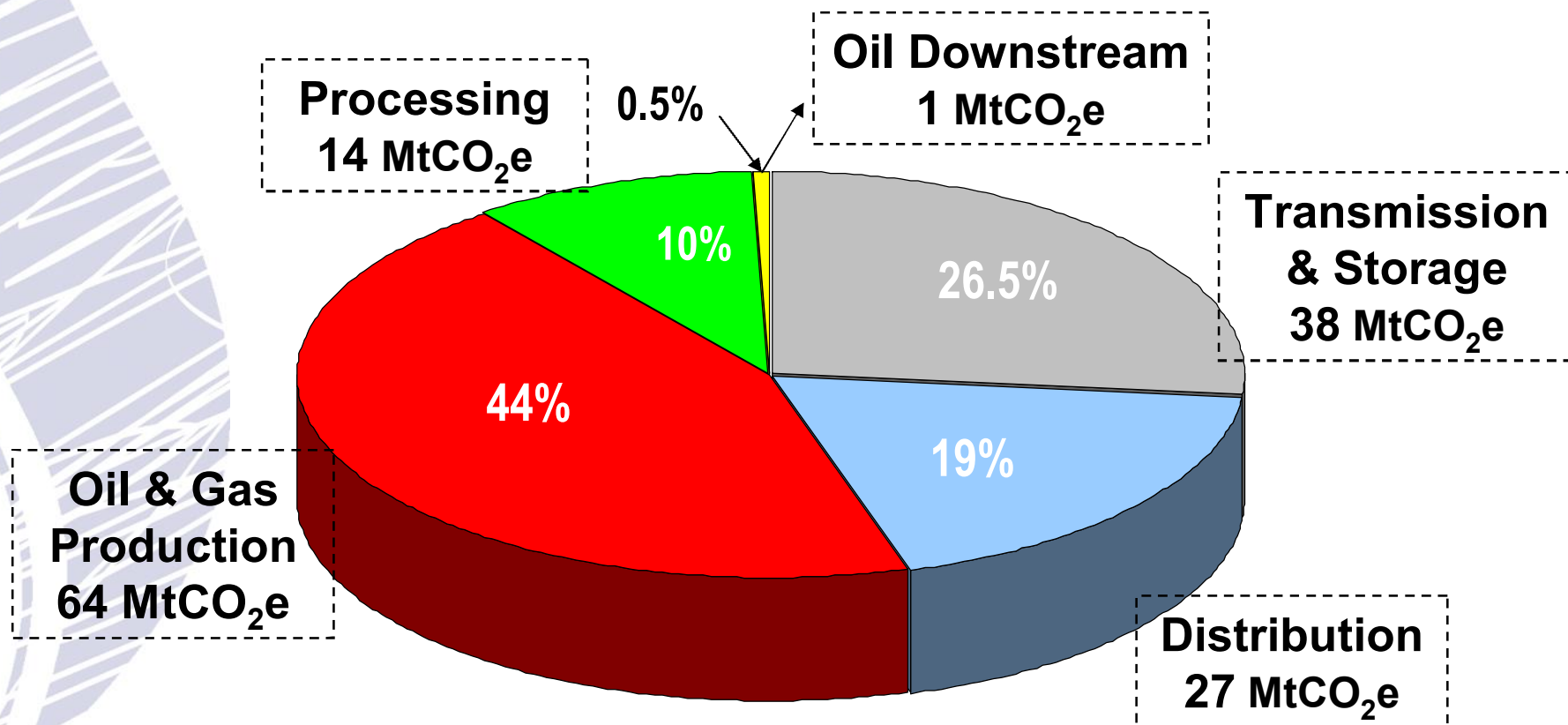
- ✓ A potent greenhouse gas (GHG) with 100-year global warming potential of 23; atmospheric lifetime of ~12 years
- ✓ The 2nd most important GHG accounting for ~18% of total climate forcing
- ✓ A primary constituent of natural gas and a valuable, clean-burning energy source

Global GHG Emissions in 2000 40,702 million tonnes carbon dioxide equivalent (MtCO₂e)



Methane Emissions from the U.S. Oil and Gas Industry

- ⚡ Methane losses from the U.S. oil & natural gas industry total 144.6 MtCO₂e
 - ⚡ Accounts for 2% of total U.S. greenhouse gas emissions



Methane Recovery Opportunities

💧 Methane-saving projects are profitable in a variety of ways:

- 💧 Sales value of recovered methane and other hydrocarbons
- 💧 Lower operating, fuel, and capital replacement costs
 - 💧 Installing state-of-the-art equipment
 - 💧 Reduced maintenance requirements
- 💧 Potential carbon market value of captured methane

Methane Recovery Projects



Leak inspection and repair



Change compressor maintenance and shutdown practices



Install vapor recovery on storage tanks



Reduced emission completions

Public-Private Partnerships can Help Realize Project Opportunities



Asia-Pacific Partnership



Voluntary, cost-effective approach
Exchange information
Address barriers
Technology transfer
Bring together interested parties and stakeholders

**Reduced emissions, increased
efficiency, maximized profits**

Natural Gas STAR Program

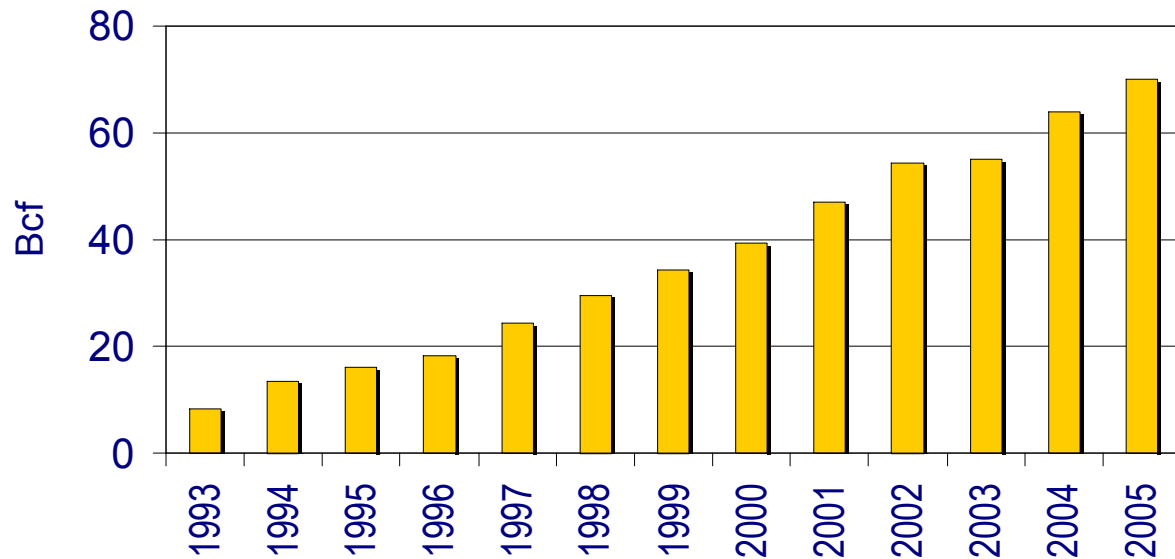
The Natural Gas STAR Program is a *flexible, voluntary partnership* between EPA and the U.S. oil and natural gas industry designed to *cost-effectively* reduce methane emissions from natural gas operations.



Domestic Natural Gas STAR

- 🔥 116 partners
- 🔥 18 endorsing associations
- 🔥 460 billion cubic feet (Bcf) cumulative methane reductions

Domestic Methane Emissions Reductions



Natural Gas STAR - Key Components

🔥 Technology transfer

- 🔥 Provide technical information and training
- 🔥 One-on-one assistance to identify and implement cost-effective methane emission reduction projects

🔥 Reporting

- 🔥 Maintain records of voluntary actions

Annual Report 2004

Natural Gas
Star

Production Sector

☐ RSP 1: Identify and replace high-leak pneumatic devices
☐ RSP 2: Implement best practices in gas operations
☐ RSP 3: Partner Request Opportunities (Please specify):

Period covered by report: From _____ To _____

Signature: _____ Date: _____

To further improve methane emission reductions, you are welcome to include other information about your company's participation in methane emission reduction programs, including any other relevant information.

Annual Reports

Lessons Learned
From Natural Gas STAR Partners

REPLACING WET SEALS WITH DRY SEALS IN CENTRIFUGAL COMPRESSORS

Executive Summary

Centrifugal compressors are widely used in production and transportation of natural gas. One of the leading safety hazards of these compressors is gas leaking from the compressor seals. Traditionally, these seals used high-pressure oil as a barrier against escaping gas. However, this oil can leak out of the seals and create a fire hazard. This "wet" seal with oil use, significantly reduces operating costs and methane emissions.

Industry estimates for wet seal costs range from \$10 to \$20 per barrel of gas. Dry seals are much less expensive, typically \$1 to \$2 per barrel of gas. Dry seals, which use high-pressure gas to seal the compressor, and dry methane gas to seal, have been used for years. However, dry seals require special equipment, require compressor and pipeline operating safety and performance, require compressor seals, and require significant less maintenance.

Although dry seal compressors might not be possible in some compressor facilities or existing design or space, in some cases, dry seals can be used to seal wet seal compressors. The replacement of wet seal compressors with dry seals can save about \$15,000 per year and pay for itself in as little as 14 months. One Natural Gas STAR partner has installed dry seals on an existing compressor. The savings, reduced emissions by 27 percent, more 75 to 200 per day, ranging about \$10,000 per year in gas sales.

Company Name	Address (Street, City, State, ZIP)	Phone (Area Code, Number)	Web Site	Year of Implementation	Notes
Midcon Energy	10000	800.555.1234	www.midcon.com	2004	10000

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Technology Transfer

Workshops



Methane to Markets Partnership

- Advances recovery and use of methane as a valuable clean energy source
- Encourages development of **cost-effective** methane recovery and use opportunities in
 - coal mines
 - landfills
 - oil and gas systems and
 - agriculture (manure waste management)
- Private companies, multilateral development banks and other relevant organizations participate by joining the **Project Network** – *over 350 organizations now participating*
- 18 partner countries

Argentina	Italy
Australia	Japan
Brazil	Korea
Canada	Mexico
Colombia	Nigeria
China	Russia
Ecuador	Ukraine
Germany	United Kingdom
India	United States



Methane Emissions from the Oil and Gas Industry

- 🔥 Methane to Markets (M2M) countries contribute 56% of global methane emissions from oil and gas systems

2005 Methane Emissions from Natural Gas and Oil Systems (MtCO₂e)

Russia	172.7
U.S.	144.6
Ukraine	90.8
Mexico	77.2
Nigeria	51.3
Canada	38.3
India	26.0
Argentina	15.1
U.K.	8.0

Germany	7.7
Australia	7.6
China	6.3
Italy	5.4
Korea	4.1
Brazil	3.7
Colombia	1.9
Ecuador	0.7
Japan	0.4

Total M2M Countries: 661.6
Total World: 1,182.0

M2M Oil and Gas Subcommittee

- 🔥 Chair: Mexico
- 🔥 Co-Chair: Russia



- 🔥 In subcommittee meetings, members have
 - 🔥 Shared goals
 - 🔥 Shared country profiles
 - 🔥 Developed oil and gas action plan

- ✓ Tomsk, Russia
- ✓ Buenos Aires, Argentina
- ✓ Villahermosa, Mexico

Recent and Upcoming Events and Projects



- 🔥 **Oil and Gas Methane Emission Reduction Workshop.** Hosted by Occidental Petroleum, Colombian Ministries of Energy and Environment. Bogotá, Colombia. October 2005

- 🔥 **Technology Transfer Workshop & Plant Tour.** Hosted by PEMEX. Villahermosa, Mexico. April 2006

- 🔥 **Canadian / U.S. Methane to Markets Gas Processing Efficiency and Methane Emissions Reduction Workshop** Hosted by CETAC-West, Environment Canada. Calgary, Alberta January 2007

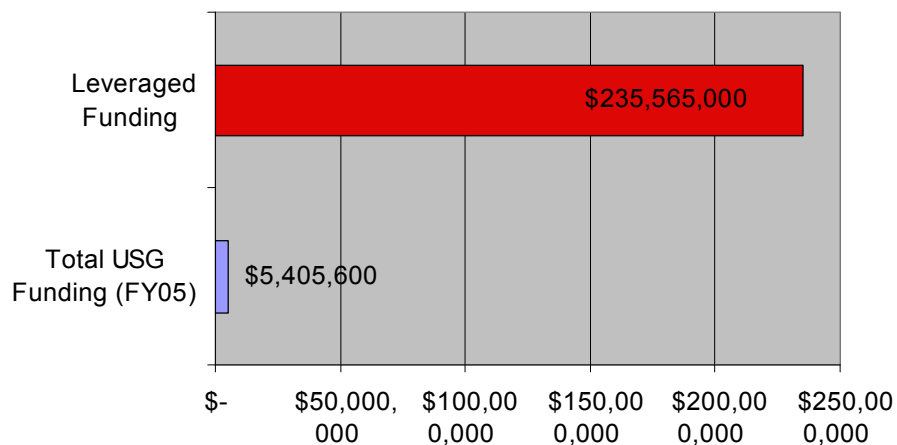
- 🔥 **Many Cost-Effective Methane Emission Reduction Projects Are Underway**



U.S. Involvement in M2M

U.S. is leveraging significant investment and engagement from the private and public sectors

USG Funding and Leveraged Funding



- U.S. is providing up to \$53 million to support the Partnership
- U.S. EPA is coordinating efforts across the U.S. government (USG) and staffs the Partnership's Administrative Support Group



U.S. Involvement in M2M

- 🔥 Key activities to advance project development;
 - 🔥 Identify and assess project opportunities
 - 🔥 Support technology transfer, training, and capacity building
 - 🔥 Address barriers to project development and increase access to information
 - 🔥 Technology demonstration and deployment
- 🔥 Ongoing projects and activities are expected to achieve annual emission reductions of 3 MtCO₂e

Natural Gas STAR International

- Under the Methane to Markets Partnership, U.S. EPA is expanding Natural Gas STAR internationally
- EPA is encouraging existing partners to engage their international operations to voluntarily reduce methane emissions
- Companies world-wide are welcome to join Gas STAR International



Methane to Markets

Oil and Gas Subcommittee



Natural Gas STAR International

Charter Partners



Participation involves:

- Developing an implementation plan
- Identifying and implementing cost-effective projects
- Reporting your success

Support from Gas STAR International is available to:

- Identify top cost-effective methane reduction project opportunities
- Conduct project pre-feasibility analysis
- On-site training and workshop development

Asia-Pacific Partnership on Clean Development and Climate

- 💧 A voluntary framework to accelerate the development and deployment of clean energy technologies internationally
- 💧 Focus on expanding investment and trade in cleaner technologies, goods, and services in key market sectors
- 💧 Eight public-private task forces: (1) cleaner use of fossil energy; (2) renewable energy and distributed generation; (3) power generation and transmission; (4) steel; (5) aluminum; (6) cement; (7) coal mining; and (8) buildings and appliances.

Asia-Pacific Partnership Countries

Australia • China • India • Japan • Republic of Korea • United States



Cleaner Fossil Task Force

- 🔥 U.S. Members: DOE, EPA, API, EPRI
- 🔥 Focus on clean coal technology and carbon storage, liquefied natural gas (LNG)
- 🔥 EPA Role
 - 🔥 Coordinating with Methane to Markets Partnership
 - 🔥 Exploring opportunities for methane recovery from oil and gas
 - 🔥 Understanding methane emissions and cost-effective reduction opportunities from LNG facilities

In Summary

- Advancing methane recovery and use opportunities can benefit the industry as well as the environment
- Public-private partnerships, like Natural Gas STAR, have proven that voluntary, cooperative efforts can deliver results
- Methane to Markets (Gas STAR International) and the Asia Pacific Partnership offer new opportunities for collaboration



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